WHAT IS CLAIMED IS:

1. A magnetic recording medium, comprising:

a substrate;

a base layer formed on the substrate and comprising a magnetic material;

a switching layer formed on the base layer and comprising a nonmagnetic material; and

a recording layer formed on the switching layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

wherein the medium meets the following condition:

$TcB > Tsw$

where TcB is a Curie temperature of the base layer, and Tsw is a temperature at which the recording layer and the base layer begin to exert exchange coupling interaction.

2. The magnetic recording medium according to claim 1, wherein the base layer comprises a ferrimagnetic material.

3. The magnetic recording medium according to claim 1, wherein a thickness of the switching layer is not larger than 5 nm.

4. The magnetic recording medium according to claim 1, wherein a distance between magnetic particles contained in the recording layer is not smaller than 1/2 of the thickness of the switching layer.

5. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a base layer formed on the substrate and comprising a magnetic material, a switching layer formed on the base layer and comprising a nonmagnetic material, and a recording layer formed on the switching layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

a heater locally heating a part of the magnetic recording medium; and

a magnetic head applying a magnetic field to the magnetic recording medium.

6. The magnetic recording apparatus according to claim 5, wherein the apparatus meets the following conditions:

$Tw > Tsw$ and $TcB > Tsw$

where Tw is a recording temperature of the locally heated recording layer, TcB is a Curie temperature of the base layer, and Tsw is a temperature at which the recording layer and the base layer begin to exert exchange coupling interaction.

7. A magnetic recording medium, comprising:

a substrate;

a base layer formed on the substrate and comprising a material that is nonmagnetic under an ambient temperature and becomes ferromagnetic at higher temperature; and

a recording layer formed on the base layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

wherein the transition temperature Tf from nonmagnetic to ferromagnetic of the base layer is made to be higher than a reproducing temperature.

8. The magnetic recording medium according to claim 7, wherein the base layer has a structure in which magnetic particles with a size that exhibits superparamagnetic properties under an ambient temperature are dispersed in a nonmagnetic material.

9. The magnetic recording medium according to claim 7, wherein an average distance between magnetic particles contained in the base layer is not larger than 5 nm.

10. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a base layer formed on the substrate and comprising a material that is nonmagnetic under an ambient temperature and exhibiting transition to ferromagnetic at higher temperature, and a recording layer formed on the base layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

a heater locally heating a part of the magnetic recording medium; and

a magnetic head applying a magnetic field to the

magnetic recording medium.

11. The magnetic recording apparatus according to claim 10, wherein the apparatus meets the following condition:

$$Tw > Tf$$

where Tw is a recording temperature of the locally heated recording layer, and Tf is a nonmagnetic-to-ferromagnetic transition temperature of the base layer.

12. A magnetic recording medium, comprising:

a substrate;

a base layer formed on the substrate and comprising a magnetic material; and

a recording layer formed on the base layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

the base layer and the recording layer being stacked to exert exchange coupling interaction,

wherein structures of the base layer and the recording layer are set to meet the following condition:

$$|TcB - Tw| < 100K$$

where Tw is a recording temperature of the locally heated recording layer, and TcB is a Curie temperature of the base layer.

13. The magnetic recording medium according to claim 12, wherein the base layer comprises an amorphous rare earth-transition metal alloy.

14. The magnetic recording medium according to claim 12, wherein the base layer has a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles.

15. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a base layer formed on the substrate and comprising a magnetic material, and a recording layer having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles, the base layer and the recording layer being stacked to exert exchange coupling interaction;

a heater locally heating a part of the magnetic recording medium; and

a magnetic head applying a magnetic field to the magnetic recording medium.

16. The magnetic recording apparatus according to claim 15, wherein the apparatus meets the following condition:

$$|TcB - Tw| < 100K$$

where Tw is a recording temperature of the locally heated recording layer, and TcB is a Curie temperature of the base layer.

17. A magnetic recording medium, comprising:

a substrate;

a base layer formed on the substrate and comprising a magnetic material;

a switching layer formed on the base layer and comprising a magnetic material; and

a recording layer formed on the switching layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

the base layer, the switching layer and the recording layer being stacked to exert exchange coupling interaction,

wherein structures of the base layer, the switching layer and the recording layer are set to meet the following condition:

$T_cS < T_cB$

where T_cS is a Curie temperature of the switching layer, and T_cB is a Curie temperature of the base layer.

18. The magnetic recording medium according to claim 17, wherein each of the switching layer and the base layer comprises an amorphous rare earth-transition metal alloy.

19. The magnetic recording medium according to claim 17, wherein each of the switching layer and the base layer has a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles.

20. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a base layer formed on the substrate and comprising a

magnetic material, a switching layer formed on the base layer and comprising a magnetic material, and a recording layer formed on the switching layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles, the base layer, the switching layer and the recording layer being stacked to exert exchange coupling interaction;

a heater locally heating a part of the magnetic recording medium; and

a magnetic head applying a magnetic field to the magnetic recording medium.

21. The magnetic recording apparatus according to claim 20, wherein the apparatus meets the following conditions:

$T_cS < T_cB$ and $0 < T_w - T_cS < 100K$

where T_w is a recording temperature of the locally heated recording layer, T_cS is a Curie temperature of the switching layer, and T_cB is a Curie temperature of the base layer.

22. A magnetic recording medium, comprising:

a substrate;

a functional layer formed on the substrate and comprising an antiferromagnetic or ferrimagnetic material; and

a recording layer formed on the functional layer and having a structure comprising magnetic particles

and a nonmagnetic wall buried between the magnetic particles;

the functional layer and the recording layer being stacked to exert exchange coupling interaction under an ambient temperature,

wherein the magnetic recording medium meets the following condition:

$T_cR < T_cE$

where T_cR is a Curie temperature of the recording layer, and T_cE is a temperature at which the exchange coupling interaction between the functional layer and the recording layer disappears.

23. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a functional layer formed on the substrate and comprising an antiferromagnetic or ferrimagnetic material, and a recording layer formed on the functional layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles, the functional layer and the recording layer being stacked to exert exchange coupling interaction under an ambient temperature;

a heater locally heating a part of the magnetic recording medium; and

a magnetic head applying a magnetic field to the magnetic recording medium;

wherein the apparatus meets the following

condition:

$$TcR < TcE$$

where TcR is a Curie temperature of the recording layer, and TcE is a temperature at which the exchange coupling interaction between the functional layer and the recording layer disappears.

24. The magnetic recording apparatus according to claim 23, wherein the apparatus meets the following conditions:

$$TcR < TcE \text{ and } |TcE - Tw| < 100K$$

where Tw is a recording temperature of the locally heated recording layer, TcR is a Curie temperature of the recording layer, and TcE is a temperature at which the exchange coupling interaction between the functional layer and the recording layer disappears.

25. A magnetic recording medium, comprising:

a substrate;

a functional layer formed on the substrate and comprising an antiferromagnetic or ferrimagnetic material; and

a recording layer formed on the functional layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

the functional layer and the recording layer being stacked to exert exchange coupling interaction under an ambient temperature,

wherein the magnetic recording medium meets the following condition:

$TcR < TcE$

where TcR is a Curie temperature of the recording layer, and TcE is a temperature at which exchange coupling interaction between the functional layer and the recording layer disappears.

26. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a functional layer formed on the substrate and comprising an antiferromagnetic or ferrimagnetic material, and a recording layer formed on the functional layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles, the functional layer and the recording layer being stacked to exert exchange coupling interaction under an ambient temperature;

a heater locally heating a part of the magnetic recording medium; and

a magnetic head applying a magnetic field to the magnetic recording medium;

wherein the apparatus meets the following condition:

$TcR < TcE$

where TcR is a Curie temperature of the recording layer, and TcE is a temperature at which exchange coupling interaction between the functional layer and

the recording layer disappears.

27. A magnetic recording medium, comprising:

a substrate;

a functional layer formed on the substrate and comprising an antiferromagnetic or ferrimagnetic material;

a switching layer formed on the functional layer and comprising a magnetic material; and

a recording layer formed on the switching layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

the functional layer, the switching layer and the recording layer being stacked to exert exchange coupling interaction under an ambient temperature,

wherein the magnetic recording medium meets the following condition:

$TcR > TcE$

where TcR is a Curie temperature of the recording layer, and TcE is a temperature at which exchange coupling interaction between the switching layer and the recording layer disappears.

28. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a functional layer formed on the substrate and comprising an antiferromagnetic or ferrimagnetic material, a switching layer formed on the functional

layer and comprising a magnetic material, and a recording layer formed on the switching layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles, the functional layer, the switching layer and the recording layer being stacked to exert exchange coupling interaction under an ambient temperature;

a heater locally heating a part of the magnetic recording medium; and

a magnetic head applying a magnetic field to the magnetic recording medium.

29. The magnetic recording apparatus according to claim 28, wherein the apparatus meets the following conditions:

$TcR > TcE$ and $|TcE - Tw| < 100K$

where Tw is a recording temperature of the locally heated recording layer, TcR is a Curie temperature of the recording layer, and TcE is a temperature at which exchange coupling interaction between the switching layer and the recording layer disappears.

30. The magnetic recording medium according to claim 22, wherein the functional layer has a multi-layered structure including at least one unit comprising a nonmagnetic layer having a thickness not larger than 5 nm and a magnetic layer.

31. The magnetic recording medium according to claim 22, wherein the functional layer includes a first

functional layer having a multi-layered structure including at least one unit comprising a nonmagnetic layer having a thickness not larger than 5 nm and a magnetic layer, and a second functional layer comprising an antiferromagnetic or ferrimagnetic material, and the first functional layer and the second functional layer are stacked to exert exchange coupling interaction under an ambient temperature.

32. The magnetic recording medium according to claim 30, wherein the nonmagnetic layer forming the functional layer comprises at least one element selected from the group consisting of Ru, Re, Rh, Ir, Tc, Au, Ag, Cu, Mn, Si, and Cr.

33. The magnetic recording apparatus according to claim 5, wherein the distance between the magnetic recording medium and the magnetic head applying a magnetic field to the magnetic recording medium is set to be smaller than 100 nm.

34. A magnetic recording medium, comprising:

a substrate;

a functional layer formed on the substrate and comprising a magnetic material; and

a recording layer formed on the functional layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles;

the functional layer and the recording layer being

stacked to exert a ferromagnetic exchange interaction under an ambient temperature,

wherein the magnetic anisotropic energy density Ku_{RL} of the recording layer is not lower than 5×10^6 erg/cc and higher than the magnetic anisotropic energy density Ku_{FL} of the functional layer.

35. The magnetic recording medium according to claim 34, wherein the recording layer has a multi-layered structure in which nonmagnetic layers comprising at least one element selected from the group consisting of Pt and Pd and having a thickness of not larger than 2 nm and magnetic layers are alternately stacked.

36. The magnetic recording medium according to claim 34, wherein each of the functional layer and the recording layer exhibits perpendicular magnetic anisotropy.

37. The magnetic recording medium according to claim 34, wherein another functional layer is formed on the recording layer that is formed on the functional layer and these three layers are stacked to exert ferromagnetic exchange interaction.

38. The magnetic recording medium according to claim 34, wherein the functional layer comprises a plurality of magnetic layers and these plural magnetic layers are stacked to exert exchange coupling in an antiferromagnetic direction.

39. The magnetic recording medium according to claim 34, wherein the recording layer comprises a magnetic material selected from the group consisting of Fe-Pt, Fe-Pd, Co-Pt and Co-Pd each comprising Cu added thereto in an amount of at most 50 atomic %, and the functional layer comprises a magnetic material selected from the group consisting of Fe-Pt, Fe-Pd, Co-Pt and Co-Pd each comprising Ag and/or Al added thereto in an amount of at most 50 atomic % or substantially comprising no additive.

40. A magnetic recording apparatus, comprising:

a magnetic recording medium comprising a substrate, a functional layer formed on the substrate and comprising a magnetic material, and a recording layer formed on the functional layer and having a structure comprising magnetic particles and a nonmagnetic wall buried between the magnetic particles, the functional layer and the recording layer being stacked to exert a ferromagnetic exchange interaction under an ambient temperature, and the magnetic anisotropic energy density Ku_{RL} of the recording layer being not lower than 5×10^6 erg/cc and higher than the magnetic anisotropic energy density Ku_{FL} of the functional layer; and

a magnetic head applying a magnetic field to the magnetic recording medium.